Influence of sulfate ions on chloride-induced reinforcement corrosion in portland and blended cement concretes

Al-Amoudi, Omar Saeed Baghabra, Rasheeduzzafar, Maslehuddin, Mohammed, Abduljauwad, Sahel N.

Cement, Concrete and Aggregates
Vol. 16, Issue.1, 1994

Abstract: Reinforced concrete structures serving in marine environments and in soils contaminated with high concentrations of chloride and sulfate salts are prone to two problems, namely reinforcement corrosion and sulfate attack. While a substantial number of studies have been carried out on reinforcement corrosion in pure chloride environments, practically no data exist on the influence of sulfate ions on chloride-induced reinforcement corrosion in plain and blended cement concretes. In this study, the effect of chloride and sulfate ions, or both on reinforcement corrosion in plain and blended cement concretes was investigated. Reinforcement corrosion was evaluated by measuring corrosion potentials and corrosion current density at periodic intervals. The mechanisms of chloride-induced reinforcement corrosion in the presence of sulfate ions was elucidated by extracting and analyzing the pore solution. The time to initiation of reinforcement corrosion was observed to be strongly related to the mobility and diffusivity of the chloride ions. Once the chloride and sulfate ions reach the steel-concrete interface, the concomitant presence of sulfates and chlorides generally increases the corrosion rate of steel in both plain and blended cements. Despite the very aggressive internal chemical environment in silica fume cement concrete, the corrosion current density was the lowest and generally below the threshold level. The longer time to initiation of corrosion and lower corrosion current density observed in silica fume cement concrete, even in very aggressive environments marked by high chloride and sulfate concentrations, emphasizes its usefulness in aggressive media.